Spectroscopy of Stars and Galaxies

Objective:
Spectroscopy is the science of looking at rainbows. By splitting starlight into its different wavelengths, or colors, we can learn a great deal. By measuring the wavelengths and strengths of absorption and emission lines seen in a star’s spectrum, we can tell what it is made of, how hot it is, and how fast it is moving.

In this lab you will examine the spectra of a few elements and compare them with some spectra of stars and galaxies taken by astronomers. In this way we can learn what is going on in atoms that are millions of light years away.

Exercises:
A. Using figure 3.5 on page 97 in your text, make a complex visible spectrum on the scale provided.

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| 400 nm | 500 nm | 600 nm | 700 nm |
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B. On the next page you will find the emission spectra of hydrogen, helium, mercury and neon and the absorption spectra of a star from a distant galaxy. At this point, you should color the specific wavelengths according to the spectrum that you completed above.

C. Suppose that you have just used an advanced spectroscope to examine a distant star. Using the spectroscope you observed radiation at the following wavelengths: 660 nm, 480 nm, 430 nm and 410 nm.

Using this information complete the emission spectrum below for the distant star.

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| 400 nm | 500 nm | 600 nm | 700 nm |
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Hydrogen

Helium

Mercury

Neon

Spectrum of a bright star in a distant galaxy:
1. What is the probable source of this radiation? In other words, what type of gas is emitting this radiation? Refer to the bright star in a distant galaxy spectrum.

D. Suppose you observed the following wavelengths: 700 nm, 690 nm, 642 nm, 628 nm, 620 nm, 585 nm, 580 nm, 534 nm and 470 nm. Use this information to reconstruct this star’s emission spectrum.

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2. What is the probable source of this radiation?

E. Look at the imaginary spectrum of “a bright star in a distant galaxy,” at the bottom of the previous page. Compare the pattern of absorption lines in this spectrum with the emission lines in the spectra of hydrogen, helium, mercury and neon.

3. What are the wavelengths of the lines shown?

4. From the pattern of lines, what would you say is the most prominent element in this star?